DOCUMENT RESUME

ED 415 107 SE 061 059

TITLE	Helping Your Child Reach the New Standards in Mathematics, Science, and Technology: Core Curriculum Content Standards. A Guide for New Jersey Parents.
INSTITUTION	New Jersey Mathematics Coalition, New Brunswick.
PUB DATE	1997-00-00
NOTE	25p.
AVAILABLE FROM	New Jersey Mathematics Coalition, P.O. Box 10867, New Brunswick, NJ 08906 ($1 per copy, or $10 per set of 20 copies).
PUB TYPE	Guides - Non-Classroom (055)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Educational Resources; Educational Technology; Elementary Secondary Education; *Mathematics Curriculum; Mathematics Education; Parent Empowerment; Parent Materials; Parent Participation; *Science Curriculum; Science Education; *Standards; State Boards of Education
IDENTIFIERS	New Jersey

ABSTRACT

In May 1996, the New Jersey State Board of Education adopted the Core Curriculum Content Standards. The standards define all concepts students are expected to achieve in seven content areas (including mathematics and science) at grades 4, 8, and 12. They also describe what all students must learn as they move from school to work and include the area of technology. This booklet aims to share the standards and the vision with parents. The changes that will occur in the classrooms are listed along with content information for mathematics, science, and technology curricula. Guides for parents to help children reach these goals are presented along with several activities related to the new standards. Resources for additional information are also listed. (ASK)

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HELPING YOUR CHILD REACH THE NEW STANDARDS IN MATHEMATICS, SCIENCE, AND TECHNOLOGY

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New Jersey's Statewide Systemic Initiative

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Leading Mathematics, Science, and Technology Education

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A GUIDE FOR NEW JERSEY PARENTS

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THE GOAL

To enable ALL of New Jersey's children to acquire the mathematics, science, and technology skills and understandings they will need to be successful in their careers and productive as citizens.

"New Jersey has recently adopted Core Curriculum Content Standards which encourage teachers and children to solve real-world problems using mathematics, science, and technology. These are three areas in which parents and children can especially enjoy solving problems together. This Guide for New Jersey Parents, prepared by the New Jersey Mathematics Coalition, suggests specific ways for parents to help their children learn mathematics and science, to appropriately use technology, and to have fun doing it. We urge all parents to read this booklet and discover with their children that there can be magic in learning science and mathematics."

Christine Todd Whitman, Governor of New Jersey
Leo Klagholz, New Jersey Commissioner of Education

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This *Parents' Guide* has been produced by the New Jersey Mathematics Coalition, in collaboration with the New Jersey Statewide Systemic Initiative for Excellence in Mathematics, Science, and Technology Education; further information about these organizations is provided on the inside back cover.

Support for this effort was provided by the New Jersey Department of Education, the Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education based at Research for Better Schools, the Rutgers University Center for Mathematics, Science, and Computer Education, and the National Science Foundation through the New Jersey Statewide Systemic Initiative.

Permission is granted to copy and distribute this booklet in its entirety. We welcome your comments and suggestions about the *Parents' Guide*. Additional copies may be ordered from the New Jersey Mathematics Coalition for $1 per single copy, or $10 per set of 20 copies.

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WHY DO WE NEED STANDARDS?

Our children need to be well prepared for lives and careers in a technological world and in a global economy. They need to be able to solve problems and reason effectively. They need to use complex information and advanced tools. They need to know and understand how to use mathematics, science, and technology. Also, both our state and our nation need people with the skills that match the new types of jobs of the twenty-first century. High standards benefit both our children and our society.

WHAT ARE THE NEW STANDARDS?

In May 1996, the New Jersey State Board of Education adopted the *Core Curriculum Content Standards*. The standards define what *all* students are expected to achieve in seven content areas, including mathematics and science, at grades 4, 8, and 12. They also describe what *all* students must learn as they move from school to work, including the area of technology.

These standards were developed by teams of educators and scientists, working with parents, business leaders, and other interested citizens. A wide variety of groups and individuals have agreed that these standards can ensure that *all* students will be ready for life after high school, whether they go on to college or head straight for the workforce. There is agreement that we should have high expectations for *all* students, and that *all* students can reach these expectations.

New Jersey's mathematics, science, and technology standards are based on the standards developed and published by the National Council of Teachers of Mathematics, the American Association for the Advancement of Science, the National Research Council, and the United States Department of Labor (SCANS Report).

The standards are based on a shared vision of what mathematics, science, and technology education can and should be. In this booklet, we share with you the standards and the vision, and we invite you to help make them a reality for your children and for all of the children of New Jersey.

WHAT CHANGES WILL YOU SEE IN THE CLASSROOM?

The standards discuss *how* students learn mathematics, science, and technology, as well as *what* they learn. In order to help your children reach the standards, teachers will be changing what takes place in their classrooms. When you ask your children about their schoolwork and when you visit their classrooms, you should find, more and more, that the following are happening:

Your children are actively involved in learning. When your children are growing plants, building models of bridges, or analyzing their own experimental data, they are more likely to become interested in learning biology, technology, or statistics. They learn best by *doing* an activity or *using* a technique, rather than simply *being told* a principle or *following* directions and rules.

Your children are excited by and interested in their activities. Children who are excited by what they are doing are more likely to learn and understand. They will stay involved for a longer period of time, and will later take more advanced courses. This happens when these subjects are taught with a real problem-solving spirit, and when your children have the opportunity to make their own hands-on discoveries in mathematics, science, and technology.

Your children are expected to achieve at a high level. Research shows that *all* children can achieve high levels of understanding and performance in mathematics, science, and technology. The new standards are high, but we short-change our children if we expect less from them. When teachers, parents, and children share these high expectations, more children will actually achieve them. The standards do not limit your child. All children who can achieve *more* than this set of expectations will be offered more challenging opportunities and will be encouraged to meet stronger challenges.

Your children are working together to learn math, science, and technology. Research shows that children often learn these subjects well when they work in groups and are able to share ideas and suggestions with each other. This also better prepares them for the work place, where people often work in teams.

Your children are writing and talking about math, science, and technology every day. Children clarify their thinking and strengthen their understanding when they put their thoughts into words. By sharing their thinking with their classmates, teachers, and parents, students develop self-confidence and demonstrate their progress.

Your children's work is being evaluated in a variety of ways. In addition to short-answer tests, new strategies are used to measure your children's achievements. These include tests with open-ended problems, teacher interviews, long-term projects, and performance-based assessments (where students are asked to perform a task and to discuss it in writing). These methods take into account how people in the real world are expected to use their knowledge.

Your children are learning the content of math and science that will help them in their future activities. In addition to mastering the basics (like the multiplication table), your children are learning what is essential for success in the "information age". Your children recognize the place of math, science, and technology in our culture, and the contributions of people in other cultures. They see the uses of these subjects in all careers. They understand that math, science, and technology are human activities, involving success and failure, uncertainty and discovery, insight and hard work.

Your children are using calculators and computers, as well as printed materials, as important tools of learning. They are using these tools to explore and understand new concepts, and they are also using them to solve problems, just like adults on the job. Over 60% of all jobs will require skills in computer and network use; any child who does not learn the essential uses of computers — word processing, spreadsheets, databases, communication, and information gathering — will find it harder to get a good job.

When your children learn math, the focus is on learning important concepts. Even when they practice basic skills, they are gaining an understanding of how math is used and how it works. Practice of computational skills is just a small part of the curriculum; more effort is devoted to the development of the other areas of mathematics described in the following pages.

When your children learn science, they are learning a way of thinking about and investigating the world in which we live. Even when they learn basic facts, they are learning how the scientific method is used to understand the world in which we live. They ask questions and help plan experiments to answer the questions. They observe the results and discuss them. They draw conclusions from their data and explain their conclusions.

Your children are challenged to use math in meaningful ways, so that they come to realize how useful mathematics will be in their lives. In math classes, they pose and solve meaningful problems. Many of these problems come from ordinary situations, and many involve applications to other areas. In science classes, they use mathematics to solve problems, to describe their observations, and to model scientific theories.

When your children learn science, they are applying scientific knowledge to explore and develop technologies which can be used to improve the quality of our lives. Both in the world of nature and in the world built by human beings, your children study systems where parts work together as a whole.

Your children are brainstorming ways in which technology can be used to solve daily problems. They propose various solutions and weigh the advantages and disadvantages of their solutions. They select solutions to explore further, and develop those solutions in greater detail. They present their solutions to the class, and discuss how well their designs have solved the problem.

WHAT YOUR CHILD WILL BE LEARNING ... IN MATHEMATICS

Mathematics is not just arithmetic. New Jersey's mathematics standards describe ten areas of mathematical content that should be explored and studied *each year* of a student's education, from kindergarten through twelfth grade. These topics are not only for high school. They are not only for college-bound students, either. Young children can learn them. Your child can explore each topic and can learn and enjoy math from the start.

Number Sense is an intuitive feel for numbers and a common sense approach to using them. It includes an awareness of the different ways in which numbers are used — for counting, for measuring, for labeling, for locating. It includes an awareness of the different types of numbers — such as whole numbers, integers, fractions, and decimals — the relationships between them, and when each is most useful. For example, middle school students should be able to move back and forth between .25, 25%, and 1/4, and recognize when each is used. Number sense includes an understanding of the size of numbers, so that, for example, middle school students should be able to recognize that the volume of their room is closer to 1,000 than 10,000 cubic feet.

Geometry and Spatial Sense is an intuitive feel for shape and space. At the elementary level, children should be exploring various shapes, in both two and three dimensions; for example, they should be classifying objects by their shapes, discussing the properties of various shapes, and putting shapes together to form new shapes. In middle school, as they learn about fractions and algebra, their understanding of shapes and space will enable them to express geometry in terms of algebra (using coordinate geometry) and to solve geometric problems numerically. (Example: *How much longer is it around a circle than across it?*) At the high school level, students use their numerical, algebraic, and reasoning skills to help them apply geometry to real-world problems.

Numerical Operations are an essential part of the mathematics curriculum. Children must understand how to add, subtract, multiply, and divide whole numbers, fractions, and decimals. Certain facts must be memorized (for example, the multiplication table), certain processes must be carried out using paper and pencil (for example, multiplying two-digit numbers), and certain problems must be carried out mentally (for example, 18 times 41 is about 20 times 40, and therefore about 800). However, it is important that children understand the meanings and uses of these numerical operations; otherwise, they will be unable to use them correctly or effectively. And, since calculators can perform numerical operations quickly and accurately, more attention should now be paid to mental math skills and estimation.

Measurement. Children need to develop an understanding of how numbers are used to describe simple things like length, weight, and temperature, and also more complex things such as pressure, speed, and brightness. They need to be familiar with common measurement units like inches, liters, and miles per hour. They also need a practical knowledge of the tools and techniques that are used for measurement.

Estimation. Children need to make an educated guess about a quantity or a measure, and to make an intelligent prediction of the result of a computation. Example: *About how much will it cost to buy the five items on a shopping list?* With the growing use of calculators, children need to be aware that they will often get impossible answers because they hit the wrong keys. One important method for detecting such calculator errors, which they should use all the time, is estimating the answer and deciding whether or not the calculator's answer is reasonable.

Patterns and Functions. The understanding of patterns is an important unifying theme of mathematics. Young children should be encouraged to look for patterns in numbers, shapes, and the world around them, and to build their own patterns. Older children can recognize the patterns that result when rules (like "add 2" or "multiply by 3") are used to transform numbers, and use variables to express such rules. High school students can analyze functions using the tools of algebra, and use various kinds of functions (including trigonometric or exponential) to describe situations in the real world. At all grade levels, children should use pattern-based thinking to solve problems.

Algebra is the language used to describe mathematical relationships. Children should develop the ability to use algebraic thinking in real-life situations; this includes recognizing quantities that are changing, naming them using variables, understanding how they are related, and using equations to express and graphs to visualize those relationships. Because graphing calculators are often used to generate graphs, increased emphasis should be placed on analyzing what the graphs mean, and on using graphs to answer questions about equations and the real-life situations they represent.

Probability and Statistics. These are the mathematical tools used to understand chance and to collect, organize, and analyze numerical data. The language of probability and statistics is used regularly in the media and in everyday conversations — for example, in weather reports, election results, product preference surveys, or sports statistics. Children need this mathematics to help them judge whether the conclusions stated by advertisers, politicians, researchers, or the media are justified by the data that they present.

Discrete Mathematics is a new branch of mathematics that deals with some of the most practical problems we face in life — such as how to find the best route from one place to another, how best to schedule a list of tasks to be done, how to allocate resources, and how computers store and retrieve information. Discrete mathematics is used by decision makers in our society, from workers in government to those in health care, transportation, and telecommunications. Its various applications help students see the relevance of mathematics in the real world.

Conceptual Building Blocks of Calculus. Some basic fundamentals of calculus are important for all children to understand, even though they may never take a formal course in calculus. One essential idea is how quantities change — the speed of a car as its position changes over time, the amount of money in the bank from year to year, or the area of a square as its sides lengthen. *What happens in the long run?* is a question which all children should be able to discuss and apply to problems involving populations and investments. At the elementary level, for example, children can see how quickly a pile of blocks grows if the number is doubled each day. Another important topic for all children is the concept of infinity — what happens as numbers get larger and larger, and what happens as patterns are continued indefinitely.

WHAT YOUR CHILD WILL BE LEARNING ... IN SCIENCE

Because New Jersey is home to many scientific and technological industries, most parents understand the need for scientific literacy in today's increasingly technological society. Lifelong scientific literacy begins with attitudes and understandings established in the earliest years. New Jersey's science standards define what all children should know and be able to do in the following seven areas as they grow toward scientific literacy.

Organisms. Students need to know about and understand the structure, characteristics, and basic needs of living things. Even very young children are interested in exploring the differences between plants and animals, the life cycles of organisms such as butterflies, and in finding out about their own bodies. Older children can understand that complex organisms are interacting systems of cells, tissues and organs, and with the help of microscopes and other tools, discover that cells themselves are made up of parts.

The Diversity of Life on earth is overwhelming and requires ways of classifying and grouping organisms in order to understand their inter-relationships. Children also need to recognize that individuals vary within every species and understand how characteristics are passed down from one generation to another. Building upon their knowledge and inquiry skills, older students should understand how changing environmental conditions can result in the evolution of a species.

The Structure and Behavior of Matter. Children need to be familiar with the underlying principles of chemistry that are essential to an understanding of the physical universe. Investigating such common forms of matter as ice and water can help young children recognize that matter can exist as a solid, liquid, or gas, and can be transformed from one state to another by heating and cooling. Students in the middle grades should be able to plan experiments and show how substances can react with each other to form new substances with properties different from those of the original substances. Older students should understand the development of models of the atom and be able to explain how atoms can bond to other atoms, forming molecules of different substances.

Motion, Forces, and Energy Transformations. Children need to be familiar with the basic principles of physics, where the study of force and motion leads them to the concept of energy. Younger children learn about different forms of energy, including heat, light and sound, though concrete activities. For instance, they enjoy investigating how sound can be produced by vibrating objects and discovering how the pitch of the sound depends on the rate of vibration. Older children might study how the force of friction acts to slow down motion or how heat flows through materials or across space. In addition to other concepts, high school students should be able to explain the mathematical relationship between the mass of an object such as a car, the forces exerted on it, and the resulting acceleration or deceleration.

Earth Systems include weather systems and other groups of interacting components that affect or shape our own planet. Children make observations of materials that make up the earth: minerals, rocks, soils and fossils, and develop ideas about how they are formed. They use different kinds of maps, identify the major features of the earth's crust, and investigate the composition, cycling and distribution of the world's oceans. Eventually, using evidence provided by fossils, layers of rock, and radioactive elements, they should understand changes that have occurred in and on the earth over time.

The Origin, Evolution, and Structure of the Universe places the earth in the context of outer space. Astronomy and space science are fascinating to people of all ages, who enjoy viewing the moon, eclipses, and other celestial objects and events. Children should be able to construct a model of the solar system and compare the earth to other planets in it. By the time they graduate from high school, young people should be able to evaluate evidence that supports scientific theories of the origin of the universe and analyze the benefits generated by the technology of space exploration.

The Environment. Children need to develop an awareness of the need to protect and preserve natural resources. Over time, they should develop an understanding of environmental issues and an ability to make informed decisions about them. They begin this process by investigating the interdependence of living things and their natural surroundings in their local areas. Building on their developing understanding of earth and life science, older students should be able to assess the environmental risks and benefits associated with human activity and apply the concept of ecosystems to understand and solve problems regarding environmental issues.

WHAT YOUR CHILD WILL BE LEARNING ... IN TECHNOLOGY

New Jersey's science standards and workplace readiness standards address the important roles that technology plays in our society and the importance of preparing New Jersey students to understand and utilize technology as learners, consumers, workers, and citizens.

Use of Technology. Children need to develop skills in the use of technology and other tools in order to improve their learning and to achieve their education and employment goals. This includes a wide array of technological devices designed to extend human capabilities. For example, children should become computer literate and be able to use the Internet to obtain information. But since technology creates change, they should learn also that their use of technology will continue to expand.

Technology as the Application of Scientific Principles. Children need to learn that the many items that human beings have created were designed, using scientific principles, to solve real problems. They need to understand and experience the design process used by inventors, designers, and engineers to develop new products and improve existing products. They should have opportunities to study technological systems and address concepts such as tradeoffs, constraints, optimization, feedback, and control. They also need to realize that the future well-being of our planet will depend heavily on how we use and restrict technology.

WHAT YOU CAN DO TO HELP YOUR CHILD REACH THE STANDARDS

As parents, there are many things you can do to help your child learn mathematics, science, and technology. Suggestions of specific activities appropriate for different grade levels are provided on pages 15-18. Most important is that your family sets a tone which supports learning and exploration. Here are some suggestions:

Expect your child to succeed and be sure that he or she understands that expectation. There is good evidence that *all* children can learn the mathematics, science, and technology in the standards. Give your children the benefit of high expectations. When you believe in them, and tell them that you do, they develop the courage and desire to succeed.

Share with your child an upbeat attitude toward mathematics, science, and technology. Even if your own early experiences were not always positive, find ways to have fun with your child while doing mathematical and technological things. You can play games and work together on activities that help your child better understand mathematics, science, and technology.

Point out how mathematics, science, and technology are used every day. The applications of mathematics and science, and the results of technology, are all around us. In the kitchen, for example, ingredients are measured, foods are changed through heating, and many special-purpose tools are used.

Encourage your child's curiosity about the world around us. Listen to their many questions, and ask your own questions. Discuss with your child how together you might find answers to these questions.

Be sure that your child sees you and other adults using mathematics every day. Children are more willing to try hard to learn a subject when they believe it is very important and relevant to their lives.

Encourage your child's enthusiasm for learning. If your child has a special interest in math or science, explore with his or her teachers and counselors ways that you can nurture that interest.

Ask your children about science and mathematics classes and look at the work they bring home. Ask them to explain their classroom activities. Learn science and math with your children. Let them see that *you* are excited when you learn new things.

Talk with your child about mathematics and solve problems out loud together. Discuss ordinary questions like *"How many packages of noisemakers should we buy for the 19 people who will be at the party?"* or *"How much longer until we get there?"* or *"Should we go on the turnpike, on Route 1, or on side streets?"*, or *"Should we pay cash for the new bike or pay it off over time?"* Reason out your answers, so that your child will understand the value and usefulness of clear mathematical thinking.

Connect to the Internet at home or at a local library, and help your child (or let your child help you) locate websites that provide information and ideas about math, science, and technology. Take advantage of opportunities provided by school homework assignments on particular topics to explore Internet resources. Look for resources related to family activities and interests.

Encourage your child to collect leaves, rocks, minerals, shells, fossils, insects, and other natural objects. Ask about the features of the individual items in the collection, and about how the entire collection is organized. Provide a place to display the collection. Go with your child to a library or bookstore to find relevant books.

Work together with your child on building interesting structures using available materials, and on creating objects which respond to a challenge. For example, build the tallest tower you can using 50 straws and a limited amount of tape.

Watch television programs about math, science, and technology with your child such as *3, 2, 1, Contact, Nova, Bill Nye - the Science Guy, the Magic School Bus, and Knowledge Net*. Afterwards, discuss with your child what you learned from the program.

Participate in a Family Math, Family Science, or Family Tools & Technology Program. If you would like an after-school family involvement program in mathematics, science, or technology conducted in your school, ask your principal or teacher to contact the Center for Family Involvement in Schools at Rutgers Univ., Bldg. 4090, Livingston Campus, New Brunswick, NJ 08903, or call (908) 445-2071.

Participate in a Math, Science, and Technology Month event in your community during April. For more information about these fun, hands-on events, call 1-800-44-APRIL.

Take your child to science museums, aquariums, zoos, or environmental education centers (see partial list below). Get on their mailing lists so you'll know about scheduled activities in advance and can plan to attend together. Field trips to the park count too!

In New Jersey:

Liberty Science Center, Jersey City, (201) 451-0006
New Jersey State Aquarium, Camden, (609) 365-3300
Edison National Historic Site, West Orange, (201) 736-5050
Sterling Hill Mine and Museum, Ogdensburg, (201) 209-7212
NJ Audubon Society Cape May Bird Observatory, Cape May, (609) 884-2736
Newark Museum, Newark, (201) 596-6550
Buehler Challenger and Science Center, Paramus, (201) 262-0984
New Jersey State Museum, Trenton, (609) 292-6464
Invention Factory Science Center, Trenton, (609) 396-2002

Near New Jersey:

New York Botanical Garden, Bronx NY, (718) 817-8700
Pocono Environmental Education Center, Dingman's Ferry PA, (717) 828-2319
Franklin Institute, Philadelphia PA, (215) 448-1200
Philadelphia Zoo, Philadelphia PA, (215) 243-1100
Bronx Zoo, Bronx NY, (718) 367-1010
American Museum of Natural History and Hayden Planetarium, New York NY, (212) 769-5100

ACTIVITIES TO DO TOGETHER

Grades K-2

Estimate and Measure. Collect about seven small jars and containers of different sizes and shapes. Ask your child to compare the jars to see which hold more and which less. Then line them up in order from least to most. Is the first actually smallest? To find out, fill it with uncooked rice. If it is really the smallest, that rice should fit into the next container. Pour all of the rice into the next one. Does it all fit? Is there room for still more? If so, add more rice. Continue down the whole line of containers in that way to see if the order is correct. -

Sort Toys. Gather a collection of objects and ask your child to sort them, in whatever way he or she wants. At first, you might use a box of buttons or an assortment of dried beans, which the child may sort by size, color, type, or number of holes. Later, you might provide a collection of very different objects, like a dozen of your child's small toys: dolls or action figures, balls, small stuffed animals, cars and trucks, and play cooking utensils. Ask your child to explain the sorting. Which things go together? Why do they go together? How are they alike? How are they different? Is there another way to sort the collection? These kinds of questions and answers will help your child develop logical thinking and classification skills.

Hunt for Shapes. Discuss with your child three-dimensional shapes that are frequently seen in the everyday world. Use their proper geometric names: cube, sphere, cylinder, cone, and rectangular prism (a rectangular box). Let your child hunt for shapes in packaging, toys, and household objects, and point them out by name when they find them. Which ones do you see most? Why?

Play Counting Games on a Calculator. If you press these keys: **0 + 1 = = = =** on an ordinary inexpensive calculator, the display will show 1, 2, 3, 4, . . . and so on. Have your child do that, counting by ones aloud with the calculator. After a while ask your child first to say the number that will come up next (and then next, and then next), and then press the = key to verify the prediction. To make the activity a little more challenging, use the same sequence of key strokes, but replace the "1" with a "2." Then, another time, try a "5" or "10" or "7."

See back cover for directions on making the Tangram shapes on the following pages.

Grades 3 and 4

Forms of Water. Pour water into a one-liter clear plastic soda bottle, filling it about halfway with water, and mark how high the water level is. Freeze the water until it is solid. What will happen when the water freezes? Will the level go up, stay the same, or go down? Will the same thing happen every time you do this experiment? Discuss these questions before and after freezing the water. Children should be able to see that the level goes up on freezing. Water is one of the few substances where the solid form takes up more space than the liquid form; that is why ice floats on ponds and lakes, protecting fish and other plants and animals below.

Time It #1. Children at this age are fascinated with how much time things take. Decide on some common tasks and let your child estimate how long they would take. He or she can then perform them while you keep time. Then let your child time other members of the family as they try the same tasks. Some tasks you might try are: tying your shoes, saying the alphabet from A to Z, or making a free-standing tower with 30 pennies.

Time It #2. Discover how many times you can do a task in a minute. For example, how many times can you bounce a ball in a minute? How many times can you push a button on a calculator in a minute? (You can keep track by pressing **0 + 1 = = =** and then keep pressing the = button; the display will show the total number of times you have hit "=".) Children can also take their pulse (the number of heartbeats in a minute), and compare it to the rates of other family members.

Musical Straws. Work with your child to build a straw recorder. Start with a paper straw, cut about 6 notches at 3/4 inch intervals, and tightly pinch together one end of the straw. Cover the notches with your fingers, and then blow gently into the pinched end of the straw, uncovering a different notch each time. Observe the pitch of the sound each time that you blow into the straw. Discuss with your child how the pitch changes as different notches are uncovered. The closer the uncovered notch is to the top of the straw, the higher the pitch of the sound.

Grades 5 and 6

Plan a Trip. Let your child help plan a family trip. If you will be driving, let your child plan the route on a map, determine the overall distance to be covered, propose a reasonable number of miles to drive each day, and figure out the amount of time it will take. Point out that different kinds of roads have different speed limits, and that rest stops need to be accounted for. There may also be places that would be nice to visit along the way. You may even want to invite your child to help you figure out an appropriate budget for the trip. How much per day for souvenirs, hotels, meals, gas, and other expenses? (If you have a computer, you can record the expenses on a spreadsheet.)

Practice Mental Math and Estimation. Ask your child to determine the tip to be left at a restaurant, to estimate the height of a really tall flagpole, and to figure out how much longer you'll be riding if you're driving at 55 miles per hour with 130 miles left to go. Share with your child the methods you used to solve these problems. Ask your child to explain how he or she solved the problems. If you have fun doing problems like these, you can make up some that will take the two of you a long time to solve. *How many boards do you think are in the boardwalk?*

Separating Colors. Colors are not always what they seem! The inks of water-soluble felt-tipped markers are often a combination of several colors. These can be separated in the following way. Place a spot of ink (or draw a line) about 1 inch from the bottom of a piece of white, dusty chalk. Place the chalk into a clear plastic cup containing about 1/2 inch of water, making sure that the water does not touch the ink, and watch what happens to the ink as the water travels up the chalk. Try this with different color markers and keep track of the results; black inks often result in the most interesting patterns because they are always a combination of many colors.

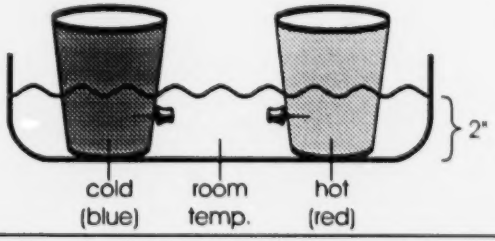
Inventions. Brainstorm ten items or devices in your home that are designed to accomplish each of the following eight "actions": Contain, hide, dispense, separate, protect, secure, attach, change shape. (For example, a bagel cutter "separates" a bagel.) Imagine combining two of the items you've named into a third device. Describe, sketch, and make a model of your new invention. (Also for grades 7-12.)

Grades 7-12

Interpret a Graph. From news programs on TV to sports pages to weather reports, the media is increasingly filled with graphs, tables, and charts that summarize information. The next time you come across a data display on a topic that would be interesting to your child, sit down together to try to interpret it. Work together to formulate answers to these kinds of questions: What conclusions can you draw from the data? What questions are raised by the data? Why is it important for you as citizens, sports fans, or consumers to understand this graph (or chart or table)? Create and analyze your own data by keeping a record of temperatures, baseball scores, store prices, or other variables. (Use a database or spreadsheet if possible.)

Inventions. See activity on previous page.

Ocean Currents. Fill a white or clear wash-basin or pan with about 2 inches of water at room temperature; this will represent the "ocean". Stick a pushpin into an 8-oz paper cup about 1 inch from the bottom and fill it with ice water colored with several drops of blue food coloring. Stick another pushpin into another 8-oz paper cup (also 1 inch from the bottom) and fill it with hot water colored with several drops of red food coloring. Place the two cups into the "ocean" with the pins facing each other, and gently pull out the pins. Observe the resulting currents for several minutes and record your observations after each minute. Which color appears to float, and which appears to sink? What happens to the hot water, and what happens to the cold water? Why? This should help explain how ocean currents develop as a result of interaction between warm and cold water.



FOR MORE INFORMATION

There are many sources of additional information about the changes now taking place in mathematics, science, and technology education, and ways in which you can help your child with these areas. This page contains materials prepared specifically for parents.

The following booklets are published by the U.S. Department of Education, Office of Educational Research and Improvement. Each is available ($0.50) from the Consumer Information Center, Dept. H-374A, Pueblo, CO 81009.

Helping Your Child Learn Math
Helping Your Child Learn Science

The following pamphlets are published by the National Council of Teachers of Mathematics and can be obtained from NCTM, 1906 Association Drive, Reston, VA 22091-1593. (800-235-7566).

Family Math Awareness Activities
Help Your Child Learn Math
Using Calculators to Improve Your Child's Math Skills

The following pamphlet is published by the Technology Educators Association of New Jersey and can be obtained by calling 201-764-7419. (For other brochures, call the International Technology Education Association at 703-860-2100.)

Technology Education: Information and Ideas for Parents

The following resource is published by the American Association for the Advancement of Science and can be purchased for $24.95 from The Learning Team at 800-793-8326.

IDEAAAS Sourcebook

FOR MORE INFORMATION

This page contains materials prepared primarily for educators, but which are also available to parents.

Mathematics:

Everybody Counts: A Report to the Nation on the Future of Mathematics Education, 114 pages, published in 1989 by the Mathematical Sciences Education Board. Available from National Academy Press, by calling (800-624-6242). ($7.95)

New Jersey Mathematics Curriculum Framework, 688 pages, published in 1996 by the New Jersey Mathematics Coalition, in collaboration with the New Jersey Department of Education. A guide to implementing New Jersey's mathematics standards in the classroom. Each New Jersey school has a copy, as do all community college libraries.

Science:

Science for All Americans, Project 2061, 272 pages, published in 1990 by the American Association for the Advancement of Science. Available from Oxford University Press by calling 800-451-7556. ($12.95)

National Science Education Standards, 262 pages, published in 1996 by the National Research Council. Available from the National Academy Press, 800-624-6242. ($23.95)

Technology:

Technology - Report of the Project 2061 Technology Panel, Published in 1989 by the American Association for the Advancement of Science. ISBN # 0-87168-347-4

Technology For All Americans: A Project to Develop National Standards for K-12 Technology Education. Available in print from the International Technology Education Association (ITEA) for $15.00 by calling 704-860-2100.

FOR MORE INFORMATION ON THE WEB

Even if you can't get to the Internet yourself, you can make use of the computer facilities at your local library. Librarians are glad to help parents gain access to the Internet.

The booklets *Helping Your Child Learn Math* and *Helping Your Child Learn Science* (see page 19) are both available at http://www.ed.gov/pubs/parents ending /Math/ and /Science/; shorter versions, *Let's Do Math!* and *Let's Do Science!* are available at the same site ending /LearnPtnrs/math.html and /LearnPtnrs/science.html

Three pamphlets published by the National Urban League *Learning Science and Math in your Community, Ten Characteristics of Good Science Programs,* and *Math Opens Doors ... And It's Fun Too!* are available from the National Parent Information Network at http://ericps.ed.uiuc.edu/npin/respar/texts/home.html

At the website of the New Jersey Mathematics Coalition, you can obtain materials from the *New Jersey Mathematics Curriculum Framework*, information about Math, Science, and Technology Month, and the Coalition Newsletter. (http://dimacs.rutgers.edu/nj_math_coalition/)

The Math Forum at Swarthmore has a website for parents and concerned citizens (http://forum.swarthmore.edu/parents.citizens.html) and sponsors the popular *Ask Dr. Math* project (http://forum.swarthmore.edu/dr.math)

Three websites which have science projects that are appropriate for families are:

Science Learning Network (http://www.sln.org/),
National Science Foundation's "Science in the Home"
(http://www.ehr.nsf.gov/EHR/EHR/scihome.html)
NJ NIE's "Compelling Projects"
(http://k12science.stevenstech.edu/curriculum/national.html).

The International Technology Education Association website has the *Technology For All Americans* project information (http:// scholar.lib.vt.edu/TAA/TAA.html)

At the website of the New Jersey Statewide Systemic Initiative (NJ SSI), you can obtain information about the statewide efforts to improve education in math, science, and technology (http://njs.injersey.com/~njssi).

NJMC

About the *Parents' Guide* and its Producers

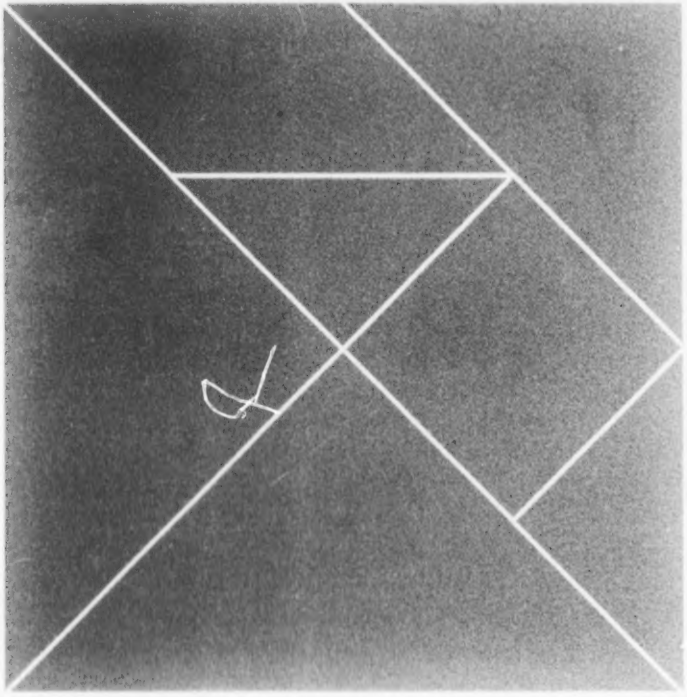
This *Parents' Guide* has been produced by the New Jersey Mathematics Coalition, in collaboration with the New Jersey Statewide Systemic Initiative for Excellence in Mathematics, Science and Technology Education.

The New Jersey Mathematics Coalition serves as a catalyst for the improvement of mathematics education and for the public's understanding of mathematics. The Coalition is a partner in the NJ SSI (see below), and coordinates Math, Science, and Technology Month each April, with the assistance of NJ SSI. To subscribe to our Newsletter (free) or for information, call (908) 445-2894 or via email at sobel@dimacs.rutgers.edu, or use our website at http://dimacs.rutgers.edu/nj_math_coalition/. Joseph G. Rosenstein is Director of the Coalition, Warren Crown is Associate Director, and Peter Sobel is Assistant Director. Manya Ungar serves as Chair of the Coalition's Board of Governors.

New Jersey's Statewide Systemic Initiative (NJ SSI) is a statewide partnership dedicated to strengthening mathematics, science, and technology education for all New Jersey students; NJ SSI is supported by the National Science Foundation, the New Jersey Department of Education, and other sources. Gerald A. Goldin is Principal Investigator and Deborah Cook is Project Director; Janet Caldwell and Carlo Parravano Co-Chair the SSI Executive Board. For information and materials about NJ SSI, please call (908) 445-2241 or write to NJ SSI, Bldg. 3870, Busch Campus, Rutgers University, Piscataway, NJ 08855-1179. (Website: http://nj5.injersey.com/~njssi.)

Support for the *Parents' Guide* was provided by the **New Jersey Department of Education** and the **Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education** based at Research for Better Schools in Philadelphia, and the **Rutgers University Center for Mathematics, Science, and Computer Education**.

Solve Tangram Puzzles. An ancient Chinese puzzle, called a tangram, consists of 7 pieces which are cut from a square. Trace the 7 pieces shown below onto another piece of paper and then cut them out. See if you and your child can use all of the pieces to make a rectangle, a triangle, a parallelogram, and a pentagon. Children (and adults!) of all ages love to solve these puzzles. How many of the designs shown on pages 16-22 can you make with all seven pieces?



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